AN ANALYSIS OF EXPORT CONTROL OF U.S. TECHNOLOGY – A DOD PERSPECTIVE

A Report of the Defense Science Board Task Force on Export of U.S. Technology

4 February 1976

Office of the Director of Defense Research and Engineering
Washington, D.C. 20301

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12 59 p.

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"The inherent contradiction of capitalism is that it develops rather than exploits the world. The capitalistic economy plants the seeds of its own destruction in that it diffuses technology and industry, thereby undermining its own position. It raises up against itself foreign competitors which have lower wages and standards of living and can outperform it in world markets."

. . . Lenin

OFFICE OF THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON, D. C. 20301

February 4, 1976

TO: THE SECRETARY OF DEFENSE

THROUGH: THE DIRECTOR OF DEFENSE RESEARCH
AND ENGINEERING

The attached report of the Defense Science Board Task Force on Export of U.S. Technology; Implications for U.S. Defense was prepared at the request of the Director of Defense Research and Engineering with cosponsorship by the Assistant Secretary of Defense, International Security Affairs. The Task Force, under the chairmanship of Mr. J. Fred Bucy, Jr., was chosen to include members with a wide variety of experience in both industry and government.

In his memorandum of transmittal, Mr. Bucy emphasizes the primary conclusion of the Task Force. The control of design and manufacturing know-how is absolutely vital to the maintenance of U.S. technological superiority. All other considerations are of secondary importance. The report has been approved by the Defense Science Board. I urge that the Department of Defense embrace the report and establish a program to implement its findings and recommendations.

Solomon J. Buchsbaum
Chairman
Defense Science Board

OFFICE OF THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON, D. C. 20301

Memorandum to Chairman, Defense Science Board

Subject: Final Report of Task Force on Export of U.S. Technology

The Task Force has developed key findings and recommendations drawn from its subcommittee reports, comments from interested public and individuals from the State and Commerce Departments, and the experience of its members. The subcommittee reports were submitted to the Defense Science Board in August, 1975.

The four subcommittees, each representing an area of high technology, were unanimous in emphasizing that control of design and manufacturing know-how is absolutely vital to the maintenance of U.S. technological superiority. Compared to this, all other considerations are secondary.

Accordingly, the Task Force placed primary emphasis on design and manufacturing know-how, and control of mechanisms that transfer it to Communist countries. Technology contained in applied research or development may be of significance for selected areas; but, overall, it is design and manufacturing know-how that impacts a nation's capability.

The recommendations and their implications focus on the Department of Defense and its role in the control of U.S. export of technology. While Defense does not have the primary responsibility for control of technology export, the Task Force believes the initiative for developing policy objectives and strategies for controlling specific technologies are their responsibility.

For the long perspective, beyond the limitations of current laws, regulations, and practice a new approach to controlling technology exports is overdue. This perspective should focus wholly on technology and not end products of technology--excepting for those critical items of direct military significance. Deterrents such as end-use statements and safeguards for protection against diversion should not be relied upon nor used.

The charter requested the identification of all technology areas in which maximum feasible protection is highly desirable. Such a comprehensive study was not pursued. Instead, four areas of high technology were selected in the expectations both of developing information on these crucial technologies and possibly of constructing

models for the Department of Defense to use for the development of similar information for other technology sectors. The results of these studies are contained in the subcommittee reports. The Task Force believes studies of other technologies would not alter its basic findings and recommendations. They would help in identifying those few technology products that should be controlled because of their critical military significance.

Further, the mechanisms of transfer were limited to those encountered by industrial firms in transferring technology to other countries and other entities. The issues and implications of technology transfer occurring under the auspices of the U.S.-U.S.S.R. Joint Commissions was noted as an area of concern, but was neither studied nor recommendations developed.

The implications of technology transfer to Western allies and neutral nations is considered only from the standpoint of potential re-transfer of strategic know-how through them to Communist nations. This is a more narrow viewpoint than that defined in the Charter. Again, the principal issue was determined to be Communist countries, and the Task Force focused almost exclusively on them as the potential recipients of technology.

Also, the subject of technology exchange, the "quid pro quo" type of agreement, was noted by the subcommittees without identification of potential exchanges for the four technology fields studied. Consequently, the report gives recognition to this topic, but does not develop further information.

It is always going to be difficult to obtain full cooperation on technology issues from CoCom member nations. Yet, CoCom agreement is vital to deterring the flow of technology. More should be done in defining objectives and paring down the issues to the substantive ones. In particular, the CoCom list should reflect the Task Force findings that controls should be exercised only over the products of technology that are of direct military significance. However, for the most critical technologies, the United States should not release know-how beyond its borders, and then depend upon CoCom agreement for absolute control.

In summary, the Task Force Findings and Recommendations concentrate on the overriding priority that must be met if the U.S. is to maintain its lead in strategic technologies. If design and manufacturing know-how are not effectively controlled, all other areas of control become moot. The Task Force urges that the Department of Defense take the lead in formulating policies that will enable other government agencies to control the export of critical technologies effectively.

J. Fred Bucy

Fred Bucy
Chairman, Task Force on
Export of U.S. Technology

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INTRODUCTION

To develop information for its Findings and Recommendations, the Task Force designated subcommittees to investigate technology transfer in specific industrial sectors. The four sectors were selected both because of their current interest to the Department of Defense, and because they are broadly representative of all "high-technology" industries. Each subcommittee studied one of the following industries:

Airframes
Aircraft Jet Engines
Instrumentation
Solid State Devices

Each subcommittee consisted of government and industry personnel selected for their individual expertise and current knowledge. Subcommittees studied the industrial structure of the U.S., Europe, and East Asia, assessed Communist countries' capabilities, then reviewed mechanisms of technology transfer, identified current key elements of technology, and made recommendations for their control. An added purpose of the subcommittees' reports was to provide sample approaches to the analysis of technology sectors, so that the Department of Defense could apply similar approaches.

The four subcommittees represent a wide diversity of industry structures, patterns of technological development, and worldwide capabilities for high-technology products. Although their major Findings and Recommendations were independently arrived at, they paralleled one another very closely and served as the basis for this Task Force report.

In assessing strategic technology; i.e., technology having military significance, the Task Force centered overriding emphasis on mechanisms that transfer design and manufacturing know-how--the detail of how to do things. Very early in their studies, the subcommittees confirmed that design and manufacturing know-how impacts a country's strategic capability far more so than applied research and development.

Additional reasons for focusing on mechanisms that transfer key know-how are fairly obvious. Acquisition of know-how is currently being given the highest priority by the industrially advanced Communist nations. It is also being sought by non-Communist nations who exercise little or no control over the export of their technologies. The release of know-how is an irreversible decision. Once released, it can neither be taken back nor controlled. The receiver of know-how gains a competence which serves as a base for many subsequent gains.

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* Served June, 1974, through October, 1974

CONTENTS

EXECUTIVE SUMMARY

The assessment of selected technologies, their impact on U.S. strategic requirements, transfer mechanisms, and current effectiveness of export control restrictions reinforce the need for export controls and the CoCom agreement as a defense necessity. The effectiveness of these controls for the more critical technologies needs to be improved through definition of policy objectives, simplified criteria, and a more pragmatic approach to the review and approval of license applications. Products of technology not directly of significance to the Department of Defense should be eliminated from controls to enable more effective control of significant items.

The findings and principal recommendations of the Task Force are discussed in these reports

I. Design and manufacturing know-how are the principal elements of strategic technology control.

These categories of export should receive primary emphasis:

1. Arrays of design and manufacturing know-how
2. Keystone manufacturing, inspection, and test equipment
3. Products accompanied by sophisticated operation, application, or maintenance know-how

II. The more active the relationship, the more effective the transfer mechanism

1. The more active mechanisms must be tightly controlled
2. Product sales do not usually transfer current design and manufacturing technology.

III. To preserve strategic U.S. lead time, export should be denied if a technology represents a revolutionary advance to the receiving nation, but could be approved if it represents only an evolutionary advance.

1. Tactics to protect lead time must differ depending on the technological position of the U.S. as compared to that of the prospective receiving country:

A. When both are on the same evolutionary track, export control decisions should weigh the receiving country's immediate gain from the acquisition of the technology.

B. When the U.S.' position results from a revolutionary gain, export controls should focus on protecting all key elements of this gain.

2. Because of its importance as a factor in strategic lead time, a viable R&D effort should be continued.

IV. Current U.S. export control laws and the CoCom agreement provide a continuing means of protecting the lead times of strategic technologies.

1. U.S. export control activity should place primary emphasis on control of the active transfer mechansims.

2. Control of product sales should emphasize their intrinsic utility, rather than commercial specifications and intended end use.

3. A simplified criteria should be developed in order to expedite the majority of license requests.

4. The U.S. should release to neutral countries only the technologies we would be willing to transfer directly to Communist countries.

5. The U.S. should pursue actions and decisions to strengthen the CoCom network of export controls.

6. Key elements of technology that constitute revolutionary gains should not be released -- excepting to CoCom nations. Any CoCom nation that allows such technology to be passed on to any Communist country should be prohibited from receiving further strategic know-how.

V. "Deterrents" meant to discourage diversion of products to military applications are not a meaningful control mechanism when applied to design and manufacturing know-how.

1. Deterrents such as end-use statements and safeguards should not be used to control applications of design and manufacturing know-how.

2. Deterrents should not be relied upon to prevent manufacturing equipment from being used for military purposes.

3. Deterrents attached to product sales may have some face value, but they should be supplemented by vehicles for enforcement against violations.

4. Deterrents should not be used when a high degree of certainty is required that diversions to military applications will not occur.

VI. The absence of established criteria for evaluating technology transfers reinforces the cumbersome case-by-case analysis of all export applications.

1. The Department of Defense should develop policy objectives and strategies for the control of key high-technology fields.

2. These objectives should include sufficient information to identify key elements of technology, including critical processes and key manufacturing equipments.

3. Technology exchange opportunities should be identified by citing technologies in which the U.S. lags the Communist world.

4. Policy objectives should be communicated broadly to interested U.S. agencies, private firms, and CoCom nations to obtain a wider base of cooperation in effecting controls.

5. Advisory committees consisting of individuals from government and private sectors should be used to recommend policy objectives and strategies.

6. The Department of Defense should reevaluate and increase the resources required to perform and implement these studies.

FINDINGS, DISCUSSIONS AND RECOMMENDATIONS

FINDING I:

Design and manufacturing know-how are the principal elements of strategic technology control.

DISCUSSION:

After examining the entire technology spectrum from basic research through maintenance of the finished product, the subcommittees concurred that the transfer of design and manufacturing know-how is of overwhelming importance to our national security. It is mastery of design and manufacturing that increases a nation's capability, and it is in this area that the U.S. maintains its technological leadership.

These elements of technology are transferred through the following export categories:

1. Export of an array of design and manufacturing information plus significant teaching assistance which provides technical capability to design, optimize, and produce a broad spectrum of products in a technical field.

   This is the highest and most effective level of technology transfer. It effects virtually total transfer of current U.S. practice in a relatively short time. Moreover, it provides a basis on which the receiving nation can build further advances in technology.

2. Export of manufacturing equipment required to produce, inspect, or test strategically related products, with only the necessary "point design" information. In this category, none of the design and manufacturing background, rationale, or alternatives is transferred.

   This export category provides incremental gains to a national capability by improving existing manufacturing capabilities or supporting infrastructure. Such equipment does not in itself transfer product design technology, nor does

it give the receiving country comprehensive insight to the entire manufacturing process. But added to an already developed technology base, specific manufacturing equipment may give a country the only means of rapid product proliferation.

"Keystone" equipment that completes a process line and allows it to be fully utilized is especially critical. The strategic significance of keystone equipment derives from its uniqueness when compared to the other process and test equipment required to produce a strategic product. If it is the only unique equipment required and all the remaining equipment is general or multipurpose, then its significance is evident. In this regard, computer-controlled process, inspection, and test equipment is often "keystone" equipment. It provides not only the capability of high throughput and improved precision, but also great flexibility in fulfilling unique and multiproduct manufacturing requirements. Moreover, it provides a growth capability on which advanced new production skills can be built.

3. Export of products with technological know-how supplied in the form of extensive operating information, application information, or sophisticated maintenance procedures.

Elements of design or manufacturing know-how are embodied in this type of information, which is often included in sales of such complex high-technology products as electronic computers and jet engines. However, this know-how is usually dated as it accrues to the product's development and design-time period. The significance of older technology is discussed in a subsequent finding.

Each of the industries studied has a different "technology profile." The critical portion of jet engine technology lies in the design and development phase of a program's life--the fundamental science and user know-how are largely in the public domain. On the other hand, the semiconductor industry emphasizes manufacturing know-how as uniquely central to their technology.

The airframe and instrumentation subcommittees use the phrases "corporate memory" and "engineering-manufacturing-marketing establishment" to reflect the importance of group experience and organization in the embodiment of their technology.

Yet among these diverse industries, there is unanimous agreement that the detail of how to do things is the essence of the technologies. This body of detail is hard earned and hard learned. It is not likely to be transferred inadvertently. But it can be taught and learned.

RECOMMENDATIONS:

Three categories of export should receive primary emphasis in control efforts, since they transfer vital design and manufacturing know-how most effectively:

1. Arrays of design and manufacturing information that include detailed "how to" instructions on design and manufacturing processes.

2. "Keystone" manufacturing, inspection, or automatic test equipment.

3. Products accompanied by sophisticated operation, application, or maintenance, information.

FINDING II:

The more active the relationship, the more effective the transfer mechanism.

DISCUSSION:

The many mechanisms for transferring technology may be arranged in a spectrum stretching from the most active where the donor actively transfers design and manufacturing know-how; e.g. establishing a "turnkey" factory, to the most passive where the donor is passive in regard to know-how transfer; e.g., a trade exhibit.

"Active" relationships involve frequent and specific communications between donor and receiver. These usually transfer proprietary or restricted information. They are directed toward a specific goal of improving the technical capability of the receiving nation. Typically, this is an iterative process: the receiver requests specific information, applies it, develops new findings, and then requests further information. This process is normally continued for several years, until the receiver demonstrates the desired capability.

Technology is transferred effectively by the more active mechanisms when the receiver has:

A well-defined goal and adequate resources committed to accomplishing it.

Key individuals competent in the technology, who will be directly involved in applying the newly received technology, and

An adequate infrastructure capable of providing necessary parts, supplies, instrumentation, and manufacturing equipment.

The Task Force believes that these factors exist in Russia and Eastern Europe, making them receptive hosts for any active efforts to transfer those technologies studied by the subcommittees.

"Passive" relationships, from a technology transfer viewpoint, imply the transfer of information or products that the donor has already made widely available to the public. Passive mechanisms do little to transfer technology. Commercial literature, trade shows, product sales, and the like rarely communicate enough know-how to transfer the essence of the technology involved.

The subcommittees find that "reverse engineering" of products, through engineering analysis, is rarely an effective technique for discovering current design and manufacturing technology. Therefore, the decision whether or not to export a finished product can be based solely on the capability conferred by that product's intrinsic utility. This characteristic should be the primary consideration, more so than the receiving country's statement of intended end use.

"Passive" mechanisms do offer some small assistance, however, They provide direction to development efforts, allowing the receiving country to concentrate its resources on the more successful approaches. Still, they leave the time required to demonstrate and practice new technology dependent upon the quantity and quality of resources applied to its development.

The matrix chart on the next page ranks 17 typical transfer mechanisms in descending order of effectiveness. This turns out also to be descending order of donor activity. Although such ranking is obviously arbitrary, it will be useful if not applied as though it were rigorously quantitative. Although the list is certainly not exhaustive, it provides a framework in which other transfer mechanisms can be easily ranked. Especially significant is the fact that the four subcommittees agreed so closely in their rankings.

FINDING II

EFFECTIVENESS OF TECHNOLOGY TRANSFER ACCORDING TO INDUSTRY AND TRANSFER MECHANISM

TRANSFER EFFECTIVE-NESS	INSTRUMENTATION	SEMICONDUCTOR	JET ENGINE	AIRFRAME	TRANSFER MECHANISM
HIGHLY EFFECTIVE (TIGHT CONTROL)	H	H	H	H	TURNKEY FACTORIES
	H	H	H	H	LICENSES WITH EXTENSIVE TEACHING EFFORT
	H	H	H	H	JOINT VENTURES
	H	H	H	H	TECHNICAL EXCHANGE WITH ONGOING CONTACT
	H	H	H	H	TRAINING IN HIGH-TECHNOLOGY AREAS
	MH	H	M	M	PROCESSING EQUIPMENT (WITH KNOW-HOW)
EFFECTIVE	M	H	MH	MH	ENGINEERING DOCUMENTS & TECHNICAL DATA
	M	H	MH	MH	CONSULTING
	M	MH	M	M	LICENSES (WITH KNOW-HOW)
MODERATELY EFFECTIVE	L	L	M	M	PROPOSALS (DOCUMENTED)
	L	MH	L	L	PROCESSING EQUIPMENT (W/O KNOW-HOW)
	L	LM	L	L	COMMERCIAL VISITS
LOW EFFECTIVE-NESS (DECONTROL)	L	L	L	L	LICENSES (W/O KNOW-HOW)
	L	L	L	L	SALE OF PRODUCTS (W/O MAINTENANCE & OPERATIONS DATA)
	L	L	L	L	PROPOSALS (UNDOCUMENTED)
	L	L	L	L	COMMERCIAL LITERATURE
	L	L	L	L	TRADE EXHIBITS

ACTIVE ↑ DONOR ACTIVITY PASSIVE

L = Low Effectiveness
LM = Low to Medium Effectiveness
M = Medium Effectiveness
MH = Medium to High Effectiveness
H = Highly Effective

The chart confirms the subcommittees' findings that effective technology transfer depends upon the active participation of the donor organization. The vernacular of each of these high-technology industries differs from the others. Yet each subcommittee, in its own language, reached the conclusion that "turnkey factories", "sale of manufacturing know-how", "licenses accompanied by major teaching", and other such active mechanisms are highly effective in transferring key technologies.

Ranking lower in effectiveness are such "moderate activity" mechanisms as documented proposals, and commercial visits. Although such exchanges do not convey comprehensive information, they may prove useful in filling specific gaps in the receiving country's technological knowledge. Donor companies must exercise caution to prevent inadvertent transfer through such mechanisms.

In evaluating the effectiveness of a transfer mechanism, attention must be focused on the amount of know-how being transferred. The form of the relationship and its name are relatively unimportant and often misleading. This truism is emphasized by the widely disparate ranking of three forms of "licensing" in the matrix. By itself, a patent does not transfer know-how but confers only the right to produce or sell a product. Frequently, a company will reproduce a process or product independently, and the patent holder will require licensing only after it has appeared on the market. This is typical "licensing without know-how." On the other hand, licenses that include know-how or extensive teaching, transfer technology very effectively.

The typical transfer mechanisms used in the matrix are those most often encountered in discussions with Eastern European nations. In discussions with Western nations, Japan, and non-Communist countries, turnkey factories are encountered less often than co-development and co-production agreements, in which some ownership rights are retained by the U.S. firm. Co-development provides an active interchange of current design technology. Co-production provides for the transfer of detailed manufacturing know-how. Both of these mechanisms are highly effective in transferring key technologies.

Government-to-government scientific exchanges are fairly recent additions to the mechanisms for technology transfer. Although not ranked among the mechanisms,

such exchanges obviously have the potential to transfer technology very actively. As such, these mechanisms need to be monitored most carefully, to ensure consistency with other policies developed to restrict the export of strategic U.S. technology.

RECOMMENDATIONS:

1. The more active mechanisms of technology transfer must be tightly controlled to prevent transfer of strategic technologies.

2. Product sales, without extensive operations and maintenance data, do not usually transfer current design and manufacturing technology. Their export should be evaluated as to the capability conferred by the product's intrinsic utility. This is a more important criteria than the receiving country's end-use statement.

3. Companies with strategic technologies must exercise caution to avoid inadvertent transfers of valuable know-how through visits and proposals.

4. Government-to-government scientific exchanges should be monitored to ensure consistency with restrictions on export of strategic U.S. technology.

FINDING III:

To preserve strategic U.S. lead time, export should be denied if a technology represents a revolutionary advance to the receiving nation, but could be approved if it represents only an evolutionary advance.

DISCUSSION:

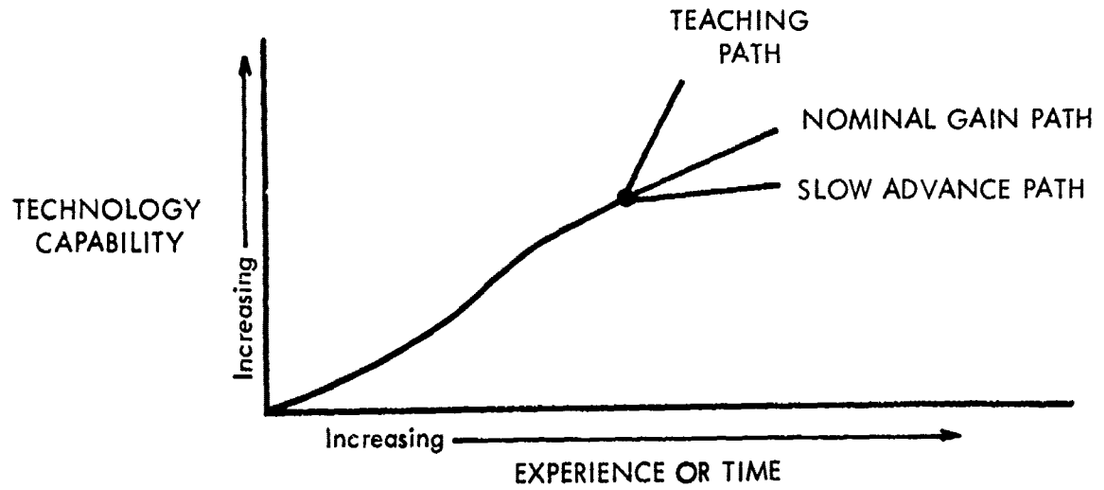
The objective of applying export controls to strategic technologies is to protect the lead time of the U.S. as compared to Comecon nations and the PRC. Lead time should be determined by comparing the position of the U.S. in the technology against both:

1. The receiving country's current manufacturing practice, and

2. The receiving country's velocity of advance in that technology.

Such a determination should be made by individuals from both government and industry who are currently involved in the practice of the art, supplemented by the whole of the intelligence community.

The three typical "velocities of technology advance" are shown in the figure that follows:



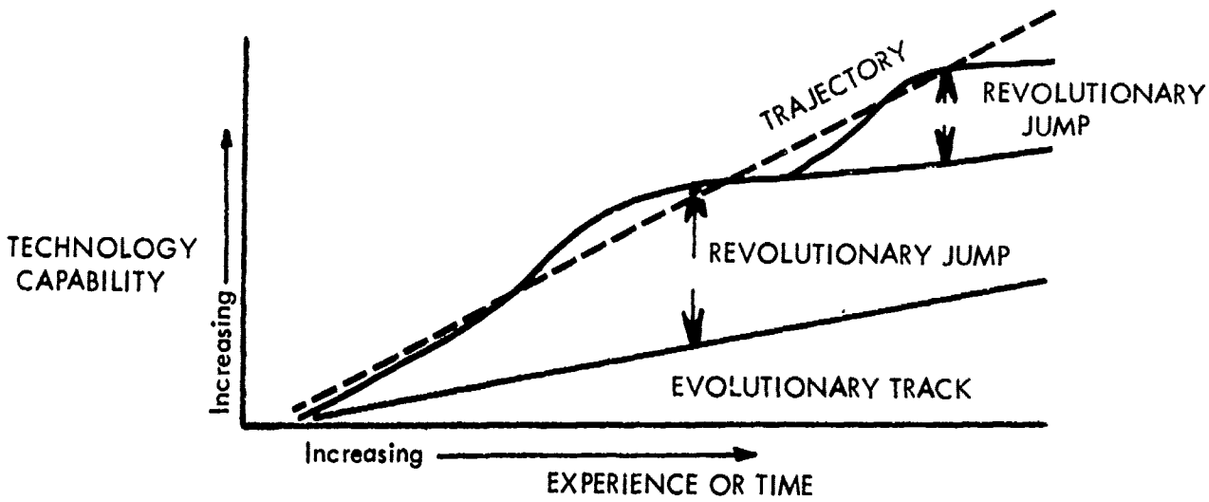
"Teaching path" velocity is typical of a nation with adequate infrastructure and a reasonable technological base, enjoying the benefits of active technology transfer mechanisms.

"Nominal gain path" velocity is typical of what a nation with adequate infrastructure and a reasonable technology base, plus R&D support comparable to that of the U.S., can maintain without imported technology.

"Slow advance path" velocity is typical of a nation with limited infrastructure, technology base, and R&D support, in the absence of active transfer mechanisms from highly developed countries.

Velocity of Technology

The velocity of advance in technology can be judged by evaluating recent progress to determine whether advances have been evolutionary (incremental) or revolutionary. Evolutionary advances are small incremental improvements that are made in the course of normal daily practice of the technology. Revolutionary advances, on the other hand, are the "quantum jumps" that are based on conceptual departures from current practice.



As suggested by the figure above, the overall velocity of a technology is the summation of evolutionary and revolutionary advances. Each revolutionary advance jumps a nation's capability to a new higher level that may not have been attained by evolutionary advances even after a number of years.

Revolutionary advances are not predictable. Typically, they occur most frequently during the early years of a technology, and less frequently once a large base of experience has been accumulated. On the other hand, evolutionary or incremental advances appear at almost a steady rate versus experience (more so than versus time).

Maximizing Lead Time Through Export Controls

Technological lead time is extremely perishable. It dissipates quickly as the basic concepts and know-how become widely known and exploited. A "lagging" country can narrow the gap even without benefit of active transfer mechanisms. This happens because the leading country must work its way up the incremental track without outside help, while the "lagging" country advances both by its own incremental efforts and by the general diffusion of technology.

Additional advantages accrue to a lagging country from the continual pursuit and practice of a technology. In this case, a country may develop an infrastructure that not only improves the rate of incremental advance for the first technology, but also provides support for advancing other technologies. And the development of a highly capable infrastructure prepares the lagging country to be a receptive host for subsequent revolutionary advances it may be able to acquire.

Each revolutionary advance affords the nation that achieves it the opportunity to maximize lead time. A revolutionary gain is easier to protect from diffusion of technology. The initial number of practitioners is small. The breakthrough is consciously recognized as valuable and proprietary. And, in some instances, such advances result from application of a different technology to the manufacturing process, requiring potential receivers to develop a new experience base before they are able to profit from the advance.

When U.S. technology is compared to that of another nation, one of two pictures typically emerges:

Both countries are on the same evolutionary track, or

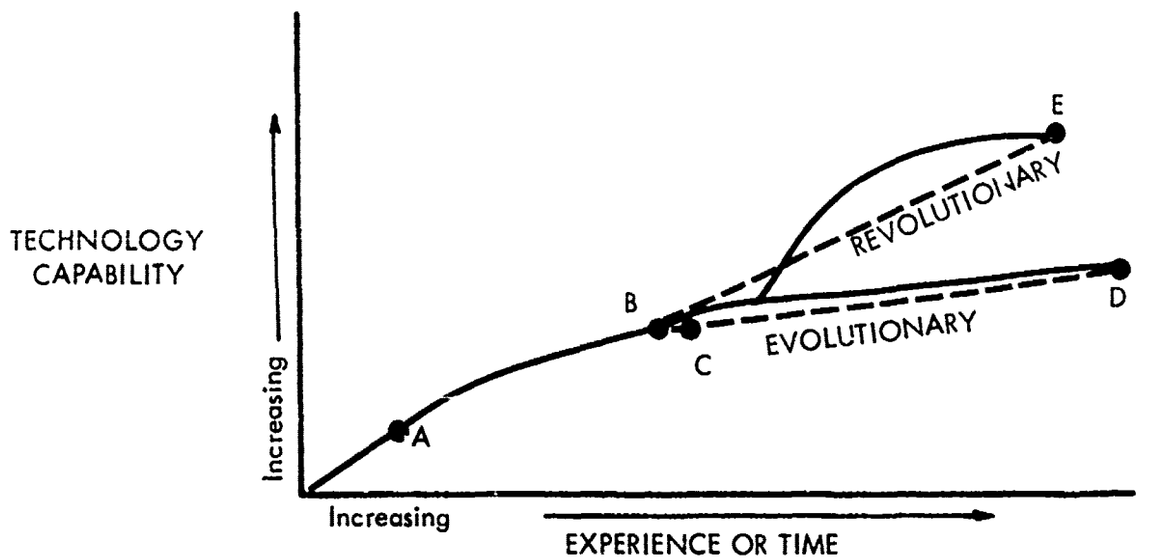
The U.S. has made revolutionary gains and is on a higher track.

The two situations demand different approaches to export control if lead time is to be maximized.

When both countries are on the same evolutionary track, the strategic gap gradually narrows regardless of export controls. Export controls should be used to provide a meaningful lead time as determined by:

1. Rate of general diffusion of technology which, to a large degree, is relatable to the number of countries practicing the technology, and

2. The proposed receiving country's competency and its ability to apply resources for the development of an infrastructure.



The application of controls, in this case, is within a framework of continual compromise between: waiting until the strategic gap narrows to the point (B - C) where transfer is of minimal value to the receiving country; and the premature transfer of accumulated evolutionary technology so far advanced (A to B, or B to D) that it effectively produces a step advance similar to that of a revolutionary gain to the receiving country.

On the other hand, in the situation where the U.S. has a revolutionary gain, (B to E), then export controls should clearly deny any transfer of the key technical elements that made this step advance possible, in order to maximize strategic lead time.

U.S. companies engaged in intensively competitive industries have long recognized the distinction between the short-term effectiveness of controlling the dissemination of technologies on an evolutionary track, and the longer effectiveness of protecting key elements of revolutionary gains.

Carefully chosen and applied export controls can aid in the maintenance and, at times, maximize the lead time of U.S. strategic technologies as compared to other nations. Equally important to the development of strategic lead time is a vigorous R&D activity that will create both evolutionary and revolutionary technological advances.

RECOMMENDATIONS

1. The objective of controlling technology exports is to maintain lead time in strategic capabilities. Tactics to protect this lead time must differ depending on the technological position of the U.S. as compared to that of the prospective receiving country:

   A. When both are on the same evolutionary track, export control decisions should weigh the receiving country's immediate gain from the acquisition of the technology, against their eventual gain of the same technology through their indigenous efforts and the general diffusion of technology. The objective of controls in this case, is to preserve a meaningful strategic lead time.

   B. When the U.S. has a superior position as the result of a revolutionary gain, export controls should focus on protecting all key elements of this gain.

2. Because of its importance as a factor in strategic lead time, a viable R&D effort should be continued.

FINDING IV

Current U.S. export control laws and the CoCom agreement provide a continuing means of protecting the lead times of strategic technologies.

DISCUSSION

The principal means of controlling the transfer of strategically important technology to Communist nations are summarized in the table following this Finding.

The control mechanisms are ranked here in order of decreasing effectiveness as reflected in the experience of individual subcommittee members:

A. U.S. Classified Weapons System

Technology embodied in classified weapons systems is most effectively controlled. The knowledge is limited to a small group of practitioners who are clearly identified and the movement of this technology is largely controlled by DoD.

Under the authority of the Munitions Act, State Department licenses control technology transfer effected as part of weapons sales to allies or other non-Communist nations. Such technology transfer occurs when the receiving nation shares in production or receives instruction in sophisticated maintenance procedures. Potential access of Communist nations to sensitive technological know-how is broadened by recently increased sales of weapons to "third countries"--Middle Eastern nations and others. For this reason, such sales should be scrutinized in terms of potential gain to Communist nations.

B. U.S. Export Control Regulations

Export of strategically sensitive products and technology requires a validated license from the Department of Commerce. The U.S. Commodity Control List identifies these items.

Although the number of items on the list has been reduced over the past three years--it is still too long--and U.S. companies still encounter frustration in trying to obtain validated licenses for high-technology product shipments to Communist countries. Industry's consensus is that the U.S. Government's processing of licenses is stricter and slower than that of our allies.

The Office of Export Control reports that they receive more than two hundred requests for validated licenses each day. Of these, about 10% (20 to 25) cover exports to Communist countries, and 35% (7 to 8) of these are processed within three weeks. No breakout is offered that specifically covers processing time for high-technology products. However, reasons were offered to explain processing delays in the case of high-technology products for Communist countries:

1. Complexity of products
2. Need for consultation with other agencies, particularly DoD
3. Impossibility of developing guidelines that would eliminate the need for case-by-case review of every request

Of special concern is that there does not appear to be selective prioritization of effort in screening the various classes of technology export. The administration of export control appears to place equal emphasis on all requests, whether they be for product sales or the more active mechanisms of technology transfer. Since the significant transfers take place through active mechanisms, it appears that present emphasis is inverse to the need--an inordinate amount of time is focused on passive mechanisms, leaving only limited time for attention to active mechanisms.

Presently, the assessment of potential product sales emphasizes relating commercial specifications and stated end use to potential military significance, which is not only cumbersome but, more importantly, involves delays and

ambiguities in making decisions. Further, this approach reinforces a tedious case-by-case analysis. The Task Force members believe that an approach based on capability as contained in a product's intrinsic utility would provide a simplified criteria which can be applied rapidly and, to the extent possible, to classes of license cases. This approach should, also, lend itself to the application of data processing for initial screening.

The Task Force suggests a pragmatic posture toward export controls--one which recognizes the objective should be to limit the flow in key areas and to maximize the benefit/cost ratio for the United States and its CoCom partners in the growing and already substantial flow of high-technology trade with Communist countries. Identification of key areas where the application of restraints is most desirable will be greatly facilitated by asking:

1. Does the material or product have a significant military utility in itself, based on performance capabilities?

2. Does it provide a critical manufacturing capability, supportive of strategic products or technologies?

3. Does the transaction involve active steps toward the transfer of technology?

4. Does it impact technology in a form useful in manufacturing or design?

5. Is the technology in question one which is changing with high velocity?

Focus of attention and administrative resources on areas with high profiles on these questions is the pragmatic posture suggested. The Task Force believes that most commercial product sales are not highly sensitive in this regard, and

that those transactions should be quickly approved by the controlling government agencies. That some undesirable technology flow would occur is acknowledged, but the Task Force believes that the overall effectiveness of our export controls would be greatly improved by such priorities. The purpose of these priorities is for the government to conserve its administrative and political resources in handling the high volume and relatively benign flow of routine commercial transactions in order to give the necessary scrutiny, restraint, and enforcement to the few, more dangerous transactions.

Certain relatively new transfer mechanisms need to be brought under better control:

1. The potential employment of U.S. citizens as key consultants in establishing manufacturing technology in Communist nations.

2. The training of Communist nations' citizens at several of the advanced technological institutes and laboratories in the U.S.

In these two cases, if the technology is of U.S. origin, its transfer comes under the export control laws. But the individuals involved may not be aware of this, and the government may not be aware of all such transfers that are taking place.

3. U.S. citizens becoming principals in firms established outside the U.S. and engaged in transferring embargoed technology to Communist nations.

Such arrangements are prohibited by the Trading with the Enemy Act monitored by the Treasury Department. But here again, violations are hard to discover.

C. CoCom Agreement

The NATO alliance members (excluding Iceland) and Japan have joined with the U.S. since the early 1950's in the Consultative Group Co-ordinating Committee

(CoCom). CoCom maintains a list of strategic products similar to the U.S. Commodity Control list. Under the informal CoCom agreement, member nations follow similar control regulations governing the export of strategic items to Communist countries (Warsaw Pact, PRC, Albania, North Korea, and North Vietnam).

In this decade, some CoCom members have perceived less need to maintain strict controls while the opportunity for individual gain through the sale of technology to Communist countries has increased.

As a result, strategic technology has been transferred to Communist nations through CoCom-sanctioned exceptions, ambiguous interpretations of lists, and, perhaps, conscious violation of CoCom agreements.

CoCom effectiveness is also diluted by differences in the national laws of its members, regarding controls of technical data. In some countries, for example, only products can be controlled--and not data.

These exceptions and leaks do compromise U.S. strategic lead times in certain technologies. Nevertheless, effective controls can only be achieved if Western nations cooperate in enforcing common export restrictions. CoCom is the only linkage among the U.S. and its allies that defines strategic technologies and restricts their export to Communist nations. CoCom must be maintained as a viable agreement.

The CoCom network of controls should be continued and strengthened through adherence and practice. The U.S. should actively pursue every activity and decision that can serve to strengthen CoCom, and take a leadership position in CoCom, rather than a reaction-mode stance. Non-essential controls should be removed, and essential controls should be made more definitive. The U.S. should prepare thoroughly for CoCom lists update by identifying the key elements of strategic technologies.

In the future, the U.S. should impose a sanction upon any CoCom country that fails to control a specific technology, by restricting the flow of know-how in that technology to the offending country.

D. Re-Exports

Many nations are building technology bases that make them potential pipelines for the transfer of high technology to Communist nations. Of particular concern is the acquisition of high-technology know-how by nations of the Middle East, and the assimilation of know-how by nations of Western Europe that are not members of CoCom--principally Switzerland, Sweden, and Austria.

U.S. export control law applies to reexportation of strategic goods and technical data of U.S. origin to a third country by the receiving firm. Since receiving nations often consider the control of reexportation as involving them in the implementation of U.S. policy objectives, the degree of enforcement is thought to be slight. Consequently, this is considered to be an ineffective deterrent except in large or highly visible cases. Further, the U.S. can prosecute only U.S. firms for violations, but not foreign firms.

Major allies of the U.S. do not have a similar law. They limit export control enforcement to acts performed within their own boundaries. Thus, strategic technology originated in these countries can be reexported through third countries to Communist nations without restriction. There is cause for concern for strategic technology possessed by foreign firms that have subsidiaries in non-Communist nations.

This uncertain control and enforcement environment among several countries dictates that the key elements of a high-velocity strategic technology--one which has experienced a revolutionary gain--should not be exported to these countries. A nation that allows strategic technology to be passed on to Communist countries should be restricted from receiving further strategic technology of U.S. origin.

E. Protection of Proprietary Know-How by U.S. Companies

The natural reluctance of U.S. companies to share proprietary know-how with competing U.S. companies is sometimes cited as an effective deterrent to sharing know-how with foreign industrial organizations. However, this mechanism was found to be ineffective in three of the four industry segments studied by the sub-committees. The sole exception was the U.S. jet engine industry. Inhibiting factors in the case of jet engines are considered to be the very small base of suppliers, long product development cycle, and large capital investment required for new products. However, in view of a recent incident, the international jet engine industry does not have these strong inhibiting factors and reacts the same as the other industry segments to Communist overtures. In other industries, however, recent history shows a consistent pattern of some companies selling know-how that other companies in the same industry consider proprietary. These selling companies seem to be swayed by the allure of exclusive access to state-controlled markets and/or large cash payments important in meeting the capital needs of the particular companies.

RECOMMENDATIONS

1. U.S. export control activity should focus primary emphasis on control of the active transfer mechanisms. The recommended trade-off is to devote less scrutiny to product sales having low strategic impact, and shorten drastically the CoCom list, for the sake of devoting thorough scrutiny to requests that would transfer vital design and manufacturing know-how.

2. Control of product sales should emphasize performance capabilities--what the product enables the user to do--rather than commercial specifications and end-use statements as at present.

3. A simplified criteria which can be applied rapidly, and to the extent possible, to classes of cases should be developed in order to expedite the majority of license requests.

4. The U.S. should release to non-allied, non-Communist countries only the technology we would be willing to transfer to Communist countries directly. This rule should extend to such technology embodied in weapon sales.

5. The U.S. should pursue actions and decisions to strengthen the CoCom network of export controls.

6. Key elements of technology that constitute revolutionary gains should not be released, except to certain CoCom nations. Any CoCom nation that allows such technology to be passed on to any Communist country should be prohibited from receiving further strategic know-how.

Current Controls on Flow of Strategic Products and Know-How

	Weapons & Technology	Strategic Products & Know-How
From U.S. to:		
1. CoCom partners	State Dept. Licenses Munitions Act	Commerce Department Licenses Export Administration Act
2. Neutral, Open Market Countries		
3. Neutral, State-controlled market countries		
4. Warsaw Pact Nations		
5. PRC		
6. Other Communist Nations		
From CoCom Countries to:		
1. Neutral, Open Market Countries	National Licenses	National Licenses
2. Neutral, State-controlled market countries		
3. Warsaw Pact Countries	CoCom Agreement and National Licenses	CoCom Agreement and National Licenses
4. PRC		
5. Communist nations (Not in Warsaw Pact or PRC)	CoCom Agreement (Albania, N.Vietnam, and N.Korea only)	CoCom Agreement and/or National Licenses
From Neutral, Open-Market Countries to:		
Neutral, state-controlled Warsaw Pact, PRC, Other Communist	Unknown	Unknown
From Neutral, state-controlled Countries to:		
Warsaw Pact, PRC, Other Communist	National Licenses	National Licenses

FINDING V

"Deterrents" meant to discourage diversion of products to military applications are not a meaningful control mechanism when applied to design and manufacturing know-how.

DISCUSSION

"Deterrents" as used in export control regulations are legal conditions under which the export of otherwise restricted or embargoed products or technology is permitted. The assumption is that their existence sufficiently discourages diversions to military use so that the sale of strategic products and technology can take place. However, such deterrents do not provide positive assurance that such diversion will not occur.

End-use statements are deterrents required by the U.S. and CoCom members because many high-technology products have multiple applications. In such cases, neither the product's specifications nor its actual performance capability confines it to non-strategic use. Product sales are approved when the "intended end-use" is clearly non-military. A better basis for such approval would be determination of the intrinsic utility of the equipment, rather than relying on a stated end use.

It should be recognized that military use of manufacturing and process equipments inherently capable of producing strategic products cannot be prevented by end-use statements. End-use statements based on the above arguments, are useful only where a product has direct consumption applications that cannot be altered.

Safeguards are an outgrowth of provisions developed for the transfer of nuclear materials. To date, use of such safeguards has been limited to computers and inertial navigation equipment. Typically, they take one of two forms:

On-site inspections, or

U.S. based maintenance only (where know-how is involved in sophisticated maintenance procedures).

Safeguards used thus far have been tailored to specific situations. In cases covering small- and medium-scale computers, safeguards have amounted to no more than an occasional visit by a seller's representative. In the case of large computers, on the other hand, provisions have included requirements that the seller maintain on-site personnel, and that detailed monthly accounting of machine utilization be submitted.

Given the great versatility of computers, it is clearly possible that commercial computers may be diverted to design or management purposes significant to the exploitation of advance technology. Although safeguards may deter such uses, detection of such diversions cannot be assured.

On another level, the widespread use of computers, even in commercial applications, enhances the "cultural" preparedness of the Soviets to exploit advance technology. It gives them vital experience in the use of advanced computers and software in the management of large and complex systems. The mere presence of large computer installations transfers know-how in software, and develops trained programmers, technicians, and other computer personnel. All of this can be redirected to strategic applications. Safeguards cannot affect this process.

In all safeguard arrangements, the seller is responsible for reporting his purchaser's violations, which creates sufficient conflict of interest by the seller that it is considered unlikely that such safeguards are rigorously enforced.

Moreover, such policing by private firms can well expose them to hostile situations without diplomatic protection from prosecution. And since the U.S. Government's interests are only loosely coupled to such protection mechanisms, private firms are understandably reluctant to report violations.

The customer must agree to safeguard measures as part of the seller's contract. Thus far, the Warsaw Pact nations have been prepared to accept deterrent provisions, such as safeguards. The Chinese Peoples Republic, on the other hand, has been reluctant to accept such provisions.

The effectiveness of deterrents is also related to the enforcement actions taken in cases of violations. Two kinds of mild sanctions are used by the U.S. Government when it learns of violations. In the case of moderate violation, the U.S. may prohibit further sales of supporting products for that particular end use. In the case of more severe violations, the exporter is denied approval of export licenses for some period of time.

Insofar as the focus of this Task Force is concerned, deterrents are not relevant mechanisms for the control of design and manufacturing know-how. Deterrents discourage the diversion of products from agreed upon end use to military uses. They do not protect the export of technology. The transfer of know-how is irreversible. Once released, it cannot be taken back, contained, or controlled. Beyond this, know-how gives the receiving nation a technological base on which to build further evolutionary and revolutionary gains.

RECOMMENDATIONS

1. Deterrents such as end-use statements and safeguards should not be used to control applications of design and manufacturing know-how.

2. Deterrents should not be relied upon to prevent manufacturing equipment from being used for military purposes.

3. Deterrents attached to product sales may have some face value, but they should be supplemented by vehicles for enforcement against violations.

4. Deterrents should not be used when a high degree of certainty is required that diversions to military applications will not occur.

FINDING VI:

The absence of established criteria for evaluating technology transfers reinforces the cumbersome case-by-case analysis of all export applications.

DISCUSSION

The environment surrounding export controls regulating the flow of products and technology to Communist nations has changed dramatically since 1970:

Communist nations are now chiefly interested in acquiring design and manufacturing know-how so that they may permanently improve their national capabilities, rather than rely on product imports from the West.

Detente has opened more trading opportunities, and "deterrents" are relied upon more often in reaction to pressures to accommodate these opportunities.

The U.S. is no longer the sole source of high-technology products and know-how.

CoCom members now have high technology and its products to sell. They view opportunities to trade with the Communist nations from the perspectives of their national export laws and policy, which are not necessarily consistent with those of the U.S.

Non-allied nations have become more strongly motivated to obtain high technology to improve economic development, military posture, and/or prestige. The increasing acquisition of strategic technology by non-allied nations represents a potential uncontrolled source of technology transfer to Communist nations.

Despite these profound changes, the emphasis and approach of U.S. technology export control has not noticeably changed. It continues to emphasize detailed analysis of every application and control of a vast list of products. In the absence of established criteria for evaluating technology transfers, this approach is not only cumbersome but results in delays, ambiguities, and a lack of guidance for firms interested in developing Communist markets.

Policies for the control of strategic technologies should be developed in advance of case-by-case requirements, so that U.S. objectives are defined and broadly understood by U.S. agencies, industrial firms, and CoCom members.

The initiative for the development of policy objectives and strategies for the protection of key strategic technologies lies with the Department of Defense. Knowledgeable individuals from both government and the private sector should contribute to the development of this information on an ongoing basis. The use of ad hoc advisory committees covering selected technologies is suggested as a means of developing the following information:

Identification of strategic technologies, and their impact on strategic missions

Identification of key elements of critical technologies, and tracking their rate of advance

Critical infrastructure requirements including key manufacturing equipments.

Once developed, this information will serve as a basis for establishing policy objectives for controlling critical technological know-how, and decontrolling non-critical products. Specific strategies should be defined stating what may be accomplished over some time horizon.

In addition, the strategy should define the events that would lead to a decision to move to a fall-back position.

The policy objectives should also provide specific information that will facilitate effective imposition of control:

List key technologies and products, stressing control on the basis of the capabilities they confer, rather than on the basis of commercial specification.

List critical processes and key manufacturing equipments

Define "quid pro quo" opportunities--identifying technologies in which U.S. lags other countries and, in particular, the Communist world.

The phrase "quid pro quo" is used by the Task Force in the context of "technology for technology." The subcommittees found no current potential of such "quid pro quo" exchange between a Communist nation and the U.S. in their technology sectors. The few technologies that have been received from the Comecon nations have, in general, been non-strategic. Nevertheless, it is important that potential opportunities be identified in advance of actual situations so that vague claims of "quid pro quo" exchanges are not used as a means of circumventing the control of design and manufacturing know-how.

Such policy objectives, if sufficiently specific, would provide clear enough guidelines that products could be sorted into appropriate classifications, the lowest classification requiring only quick assessment, and the highest classification requiring thorough analysis. It is felt that the review process, if carefully defined, could consign the routine processing of many license requests to data processing techniques.

A further result of clearly defining objectives for controlling technology transfers should be an improvement in the ability of the Department of Defense to persuade other U.S. agencies and the CoCom nations to effectively control the more significant technologies. The improved response time, defined objectives, and the implicit liberalism of its approach toward commercial East-West trade should prove an important asset in this connection.

The development of this information will require the assignment of additional technical personnel to export control areas by the Department of Defense. The importance of protecting strategic technologies versus the resources required is a trade off that merits reevaluation. The Task Force believes that the current resources are insufficient. However, after these initial studies have been developed and control emphasis has been shifted from case-by-case analysis to scrutiny of critical technology issues, the ongoing resources may be comparable to present level.

An attempt was made to describe a general flow of information gathering and the key decision points in the evaluation of a technology transfer case. The charts at the end of this Finding, represent how it might take place, rather than a study of what actually is required. As such, their use was principally to provide insight into how the subcommittees' findings could be implemented. They suggest how definitive policy objectives and strategies can be applied to develop timely and consistent recommendations.

RECOMMENDATIONS

1. The Department of Defense should develop policy objectives and strategies for the control of key high-technology fields.

2. These objectives should include sufficient information to identify key elements of the technology, including critical processes and key manufacturing equipments, and specify the few critical product items of direct military significance.

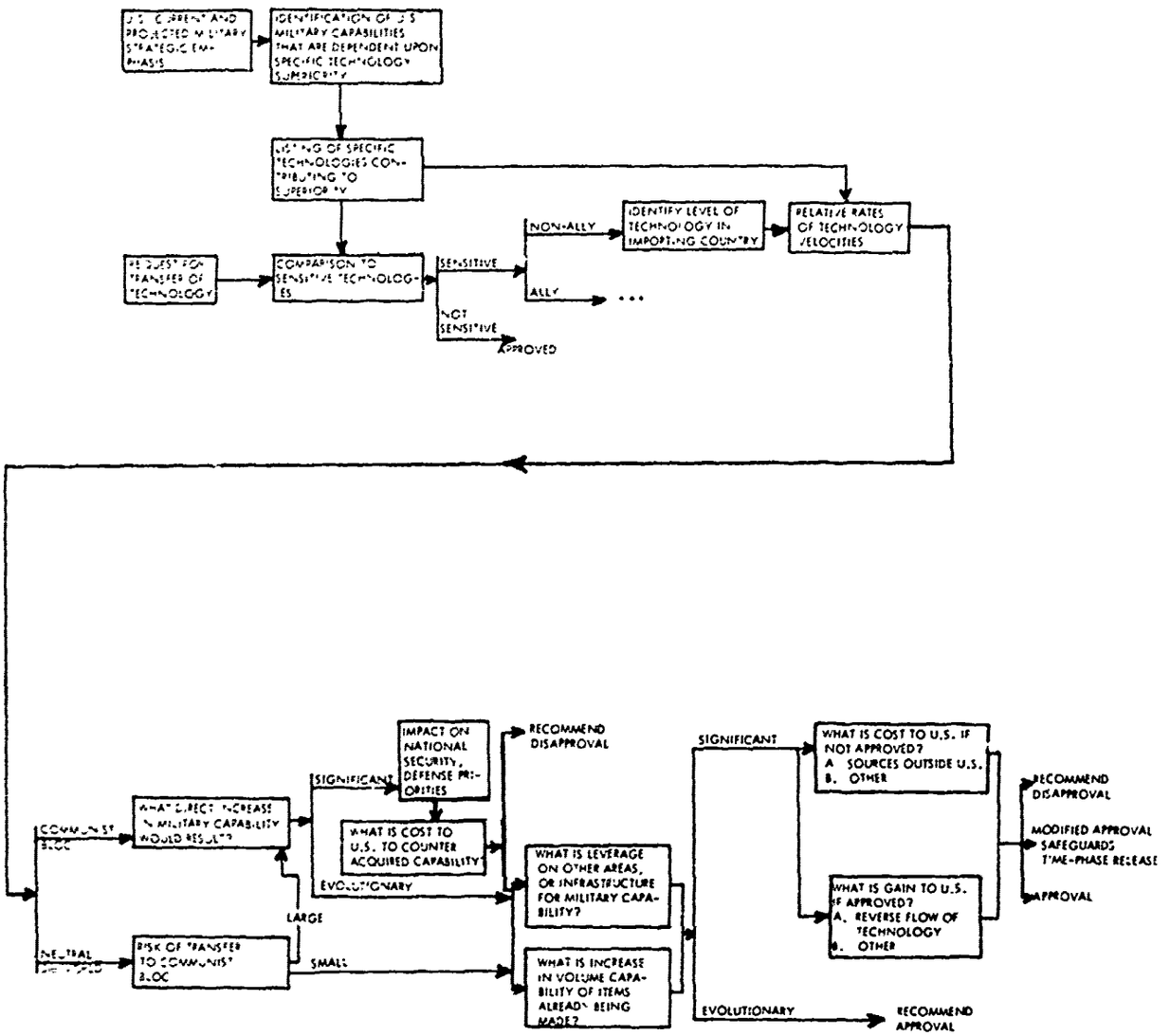
3. Technology exchange opportunities should be identified by citing technologies in which the U.S. lags the Communist world, so that subsequent claims of a "quid pro quo" exchange are not used as a means to circumvent the control of a strategic technology.

4. Policy objectives should be communicated broadly to interested U.S. agencies, private firms, and CoCom nations, to obtain a wider base of cooperation in effecting controls.

5. Advisory committees consisting of individuals from government and private sectors should be used to recommend policy objectives and strategies, and to update them continuously.

6. The Department of Defense should reevaluate and reassign the resources required to perform and implement these studies.

DECISION FLOW FOR ASSESSING STRATEGIC TECHNOLOGY TRANSFERS



TECHNOLOGY TRANSFER FLOW

1.0 INITIAL DATA (GIVEN)

1.1 NATURE OF ITEM
- PRODUCT
- KNOW HOW
  - DESIGN
  - MANUFACTURING
  - MANAGEMENT
- TIMING
- COMMERCIAL
- MILITARY
- DUO CMMC'L - MIL.

1.2 END USE & USER
- LEGITIMACY
- COMMERCIAL
- MILITARY
- DUO CMMC'L - MIL.

1.3 COUNTRY
- ALLY
- NEUTRAL
- THIRD WORLD
- MIDDLE EAST
- COMMUNIST PRESENCE
- BLOC
- THIRD COUNTRIES

2.0 DETERMINATIONS

2.1 NATIONAL SECURITY
- JUSTIFIABLE NEED
- CONTRIBUTION TO U.S. MIL. OBJECTIVES
- CONTRIBUTION TO MILITARY CAPABILITY OF FOREIGN COUNTRY
- IMPACT ON U.S.
  - MILITARY CAPABILITY
  - DEFENSE BUDGET
  - TECHNOLOGY BASE
  - INDUSTRIAL BASE
- CONTRIBUTION TO ARMS RACE
- RISK AND PENALTY OF DIVERSION
- INTELLIGENCE BENEFITS

2.2 SENSITIVITY OF TECHNO.
- KEY TECHNOLOGY
- POINT ON U.S. TECHNO. CURVE
- POINT ON FOREIGN COUNTRY'S TECHNO. CURVE
- DEGREE AND SCOPE OF DISCLOSURE
- PERISHABILITY OF U.S. LEAD
- SAVINGS ON FOREIGN COUNTRY'S RESOURCES
- REVERSE FLOW OF TECHNO.
- AVAILABILITY
  - BLOC
  - NON-COCOM
    - NEUTRALS
  - COCOM

2.3 ECONOMIC
- RETURN ON USG INVESTMENT
  - R&D RECOUPMENT
  - FAIR MARKET VALUE OF TECHNOLOGY
- FOREIGN COMPETITION
- IMPACT ON U.S. ECONOMY
- BENEFITS TO CONTRACTOR
- NET ECONOMIC PAYOFF
- INFLATION
- EXCHANGE RATE
- BALANCE OF PAYMENTS
- USG CREDIT

2.4 FOREIGN POLICY (DETERMINED BY STATE) E.G.
- WORLD PEACE
- DÉTENTE
- ECONOMIC AND SOCIAL DEVL
- U.S. INFLUENCE AND PRESTIGE
- ETC.

3.0 DECISION CRITERIA

3.1 NATIONAL SECURITY

3.2 CONTROL SENSITIVE TECHNOLOGY

3.3 MUTUAL ECONOMIC ADVANTAGE

3.4 ADVANTAGEOUS TO FOREIGN POLICY

4.0 DECISION

4.1 NO OBJECTION

4.2 NO OBJECTION WITH PROVISOS
- SAFEGUARDS
  - TECHNOLOGY
  - DIVERSION TO MILITARY USE
- TIME-PHASE DISCLOSURES
- DISCLOSURES BASED ON INCREMENTAL COMMITMENTS
- BASELINE PRODUCTS & TECH ASSISTANCE
- THIRD COUNTRY
- R&D RECOUPMENT
- TECHNOLOGY CHARGE

4.3 OBJECTION
- NATIONAL SECURITY
- KEY TECHNOLOGY
- ECONOMIC
- PREMATURE
- FOREIGN POLICY

	KEY TECHNOLOGIES	MISSION AREAS														
		STRATEGIC			TACTICAL				DEFENSE WIDE			MGMT & SPT		HUMAN RESOURCES	
		OFFENSE	DEFENSE	CONTROL	AIR WARFARE	LAND WARFARE	OCEAN CONTROL	COMBAT SUPPORT	COMM.	NAV	INTEL	RANGES	MGT INFO SYS	BIO MEDICAL	PERS DEVL
PECULIAR	NUCLEAR														
	INERTIAL														
	STRUCTURES														
	PROPULSION														
	SEMICONDUCTOR														
	COMPUTER														
	ELECTRO-OPTICAL														
	ACOUSTICAL														
	CHEMICAL														
COMMON	MATERIALS														
	DESIGN														
	MANUFACTURING														
	MANAGEMENT														
	MARKETING														
	O&M														

CONCLUSIONS AND IMPLEMENTATION

CONCLUSIONS

The principal findings of the Task Force are:

1. Design and manufacturing know-how are the key elements for control of a strategic technology.

2. This know-how is most effectively transferred when there is intent to do so, and the donor organization takes active steps in that direction.

3. High velocity; i.e., rapidly changing technologies are the ones for which export controls are most effective in slowing the flow of technology.

In the absence of established criteria for evaluating technology transfers, a cumbersome case-by-case analysis of all license applications covering a huge list of products is pursued leading to delays, ambiguities, and a lack of guidance for firms developing Communist markets.

The emphasis for screening license applications should be shifted to the more active mechanisms of transfer, which can be identified by asking:

1. Does the material or product have a significant military utility in itself, based on performance capabilities?

2. Does it provide a critical manufacturing capability, supportive of strategic products or technologies?

3. Does the transaction involve active steps toward the transfer of technology?

4. Does it impact technology in a form useful in manufacturing or design?

5. Is the technology in question one which is changing with high velocity?

The initiative for the development of policy objectives and strategies for the protection of key technologies lies within the Department of Defense. Knowledgeable individuals from both government and the private sector should contribute to the development of the following information for selected technologies on an ongoing basis:

Identification of strategic technologies, and their impact on strategic missions.

Identification of key elements of critical technologies, and tracking their rate of advance.

Critical infrastructure requirements including key manufacturing equipments.

Adequate, technically competent resources should be directed to the development of this information and its application. A result of defining the objectives for controlling strategic technologies, and only these should improve the ability of the Department of Defense to persuade other U.S. agencies and the CoCom nations to effectively control these technologies.

Deterrents, such as end-use statements and safeguards, used to discourage the diversion of products to military applications should not be used as a control mechanism for design and manufacturing technology and keystone manufacturing equipments.

The acquisition of strategic know-how by neutral nations is of increased concern. In order to minimize the flow of strategic technology through this channel to the Communist world, the key elements of a high velocity technology--one which has experienced a revolutionary gain--should not be released to them; and the know-how included in weapon sales to them should be consistent with the technology that would be released to them under scrutiny of export control reviews.

In conclusion, the Task Force believes that these findings have considerable relevance to the Department of Defense's policies toward U.S. export controls and CoCom

restraints. It believes that export controls remain a defense necessity. Although the CoCom agreement has become increasingly difficult to enforce, it is the only available vehicle through which the U.S. and its CoCom partners can work to control the flow of strategic technology to the Communist world. The principal recommendations of this report, as they are implemented, should aid in in strengthening U.S. and CoCom control of critical design and manufacturing know-how.

IMPLEMENTATION

The Task Force members are concerned that while the recommendations focus on changes in the approach and policies for controlling the export of U.S. technology, they do not always describe specific actions for immediate implementation. During the Task Force meetings, potential actions entered into the discussions, but they were excluded from the recommendations since the study of specific operations involved in the administering of export control regulations was beyond the scope of the Task Force's charter.

The implementation of the Task Force's recommendations centers on the following actions:

1. The Department of Defense should identify principal technologies that require export control.

   A. The objectives and strategies for controlling these technologies should be developed by knowledgeable individuals from government and private sectors. In addition, these study groups should identify critical elements of each technology as defined in the report.

   B. Adequate resources should be assigned to interface with the groups developing this information, to provide a means for implementation of these objectives in assessing technology transfer cases.

   C. These objectives and strategies should be developed as quickly as possible, and communicated to other U.S. agencies and CoCom member nations.

   D. Specific guidelines for these technologies should be prepared and released to private firms.

2. The administration of export control regulations should emphasize the scrutiny and control of the more active mechanisms of technology transfer.

   A. A screening list to identify quickly the active mechanisms as described in Finding III, should be developed and applied.

   B. A simplified criteria for evaluating product sales, emphasizing intrinsic utility rather than commercial specifications and intended end use, should be developed and applied to classes of products.

   C. Aggressive goals should be established for the time required to respond to license requests; e.g., 90% of all requests would be answered within 10 days and 8% within two months. Studies should then be undertaken to find solutions and alternates that would allow these goals to be realized.

   D. Development of a "decision-tree" analysis that would lend itself to computer-aided screening of license applications should be undertaken. Experienced groups such as consultants in this field or computer systems specialists in the Commerce Department could be used to develop these methods,

3. A comprehensive study of active mechanisms for transferring technology that are beyond the normal scrutiny of export control administration should be made by the Department of Defense and recommendations developed for monitoring and controlling them.

   A. Government-to-government scientific exchanges.

   B. The use of U.S. citizens as consultants for key technologies by Communist countries.

C. The participation of U.S. citizens as principals in firms established outside the U.S. and engaged in transferring embargoed technology and products to Communist nations.

D. The training of citizens from Communist countries at the more significant laboratories of U.S. technical institutes and universities.

E. Review of the criteria used for evaluating know-how transferred as part of weapons sales.